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upon those integers whose ratios best represent those of the revolution-periods. This character is probably most peculiar and beautiful, because most distinct, when the period-ratio is

$$\cfrac{1}{n+\cfrac{1}{1+\,..\,\cfrac{1}{1+\cfrac{1}{p}}}} \qquad [n \text{ an integer, } p \text{ large,}]$$

as in the actual solar system; for were the period-ratio

$$\cfrac{1}{n+\,..\,\cfrac{1}{a+\cfrac{1}{b+\,..\,\cfrac{1}{c+\,..}}}} \qquad [n, .. \, a, b, .. \, c, .. \text{ integers, } b > 1,]$$

the character due to the ratio $\left(\frac{1}{n}+\,..\,\frac{1}{c}\right)$ would be somewhat confused and overlaid by that of the lower ratio $\left(\frac{1}{n}+\,..\,\frac{1}{a}\right)$. Since p is large, the pattern nearly repeats itself after a few revolutions.

Professor Peirce thought that different discussions would require different criteria of excellence in the representation of the constant-ratios involved; and that it would be of interest to determine that form of V which is smallest for those approximate period-ratios which best represent the aggregate of all "terms of long period" in the theory of two or more planets.

Five hundred and thirty-fifth Meeting.

May 24, 1864. — ANNUAL MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters relative to the exchanges of the Academy; also a letter from Richard H. Dana, Jr., in acknowledgment of his election into the Academy.

The Report of the Council upon the changes which have occurred in the Academy during the past year was presented, and read in part by the Corresponding Secretary, as follows: —

Since the last Annual Meeting the Academy has received an accession of seventeen new members, viz. five Resident Fellows (two of them in the First Class, one in the Second, and two in the Third Class); seven Associate Fellows (two in the First, one in the Second, and four in the Third Class); and five Foreign Honorary Members, i. e. Professor Graham, of London, in the place of the late Professor Mitscherlich; William Lawrence, of London, in the place of the late Sir Benjamin Brodie; Professor Max Müller, of Oxford, in that of the late Jacob Grimm; Henry H. Milman, the Dean of St. Paul's, in the place of the late Archbishop Whately; and Frederick Overbeck, of Rome, in that of Christian Rauch.

During the year no less than fourteen members have been stricken by death from the ranks of the Academy, — a loss not only numerically large, but noteworthy from the many distinguished names which it embraces. Of this long list four were Resident Fellows, six were Associate Fellows, and four were Foreign Honorary Members of the Academy.

The Resident Fellows thus withdrawn are: Professor Edward Hitchcock and Mr. Francis Alger, of Class II., Section 1, and Dr. George Hayward and Dr. John Ware, of Class II., Section 4.

EDWARD HITCHCOCK, a distinguished member of our Geological Section, elected into the Academy thirty years ago, died at Amherst, on the 27th of February last. He was born at Deerfield, Massachusetts, on the 24th of May, 1793, i. e. exactly seventy-one years ago, received such education as was afforded by the academy of that village, where he early developed a fondness for scientific knowledge, especially for mathematics; he studied theology at New Haven, and was for four years pastor of a church at Conway, Massachusetts. He was called in the year 1825 to the chair of Chemistry and Natural History in Amherst College, — an institution with which his name is inseparably connected, and which, for its general prosperity, no less than for its renowned scientific cabinets, doubtless owes far more to him than to any other individual. He was for almost forty years a Professor, and for ten years President of the College. A list of his publications is appended to a volume which he published shortly before his death, entitled "Reminiscences of Amherst College." These are very numerous and various. "Sixteen volumes and pamphlets," and "fifty-three papers in the journals," are enumerated as scientific productions. All of them which are of permanent interest relate to geology. His principal contributions to science are contained in his Reports on the Geology of Massachusetts, his papers on Ichnology or Fossil Footmarks in the Connecticut Valley, and his "Illustrations of Surface Geology." The former embody the results of his two official surveys of the State, undertaken, the first in 1832, the last and most elaborate in 1837. The first survey was ordered by the State, at Professor Hitchcock's suggestion. It was (with the exception of an attempt on the part of North Carolina) the inauguration of the long and noble series of State and Territorial Geological Surveys under which the geology, mineral resources, and indeed the whole natural history of North America, have been developed during the last thirty years, and which have produced such important results, both for science and for the material interests of the country. Professor Hitchcock not only explored twice the whole breadth of his native Commonwealth, but was also engaged in the survey of two adjacent States. That of New York, one district of which was consigned to his charge, he gave up at the outset, on account of feeble health. That of Vermont he courageously undertook even in old age, and under increasing infirmities, and, aided by his two sons, he brought it two years ago to a successful issue. His volume entitled "Illustrations of Surface Geology," which passed to a second edition in the year 1860, is supplementary to his Final Report on the Geology of Massachusetts. That portion of it which answers to the title, although only a beginning or a local fragment of a department the facts of which are spread over the whole breadth of the continent, has the merit of being almost the only special investigation of American terraces.

But his scientific fame will mainly rest upon his researches in Ichnology, or the study of fossil footprints; that is, upon his investigations and illustrations of the tracks imprinted by animals, either birds or reptiles, or both, upon the mesozoic rocks of the Connecticut Valley. The late Dr. Deane and Mr. Marsh of Greenfield had, indeed, brought these objects to his notice, and had pronounced them to be the tracks of birds, — for which these gentlemen were entitled to special acknowledgments; but the scientific investigation belonged almost wholly to Professor Hitchcock, and has been, indeed, the most arduous, and perhaps the most important, scientific work of his life. The results of these researches, conducted under considerable disadvantages, from the want of adequate scientific preparation, are embodied in his Final Report on the Geology of Massachusetts; in his extended paper on

"The Fossil Footmarks of the United States," with twenty-four plates, published in the fourth volume of the Memoirs of this Academy; in his "Report on the Ichnology of New England," with sixty plates, published by the State, in the year 1858; and in a "Supplementary Report on the Ichnology of Massachusetts," read last year before this Society, and soon to be published by the Commonwealth.

We cannot here call attention to Professor Hitchcock's prolonged services to the cause of education, nor to his various writings upon literary, moral, or religious subjects, many of which have a wide popularity; although, indeed, his numerous published discourses, articles, or volumes upon natural theology, and upon the relations of science to revealed religion, ought not to be overlooked. These, indeed, are characteristic of the man, who was a divine as well as a geologist, not only profoundly convinced that revelation and nature are in essential harmony, but who habitually drew illustrations and arguments from the one for the other with a freedom and confidence that have rarely been equalled. At the age of threescore and ten, under much infirmity, he declares that his "attachment to the works of Nature has all the ardor and enthusiasm of youth"; and also that, as its highest and an unexpected service, "Geology has deepened his convictions of the truth, not only of natural, but of revealed religion." These relations, indeed, were the subjects of his fondest contemplation. He counts it as the great failure of his life that he had been unable to fulfil his long-cherished intention of writing a systematic treatise upon Natural Theology, — a work which, after years of preparation, he "was almost ready to begin," just when his unwilling acceptance of the Presidency of Amherst College — bringing onerous and uncongenial duties upon advancing years and an enfeebled frame — compelled a final abandonment of the undertaking. It may be doubted, however, whether a treatise from his pen would have added much of importance to what is contained in his published essays and articles upon this class of topics, — some of them very elaborate, and in their way excellent, but perhaps none of them so accurately grounded in science, or so closely reasoned, as to answer the difficult questions of the day, or to secure a permanently high rank in this field of inquiry. But this excellent man has himself modestly remarked, that most of his publications "were not written with the expectation that they would go down to posterity, but to aid a little in advancing present knowledge, in adding some items that should go into the general stock; so that, although the works themselves might be forgotten, some feeble influence at least might remain upon the great cause of learning and religion."

It is almost superfluous to add, that Dr. Hitchcock was a man of extreme simplicity and sincerity of life and character; never disposed to over-estimate himself, nor desirous of being over-estimated by others. But it cannot be doubted that his scientific labors, pursued under many discouragements, with entire singleness, but with much tenacity of purpose, have secured for him an honored name in the records of science. He will be remembered as one of the leading pioneers of New England geology, as one of the original promoters of the system of State and National Geological Surveys, and as essentially the founder of a new department of paleontology. Nor should it be forgotten that he was a prominent originator of the American Association of Geologists and Naturalists; and when this small but spirited organization took the more comprehensive form of the American Association for the Advancement of Science, he continued a conspicuous sharer in its labors and discussions.

FRANCIS ALGER, who was elected into the Academy thirty-two years ago, was born in Bridgewater, Massachusetts, on the 8th of March, 1807. He had only a common-school education, but he was a very intelligent and exact observer of facts and of natural phenomena. His attention was first attracted to mineralogy as early as in the year 1824. Two years afterwards he accompanied his father to Annapolis Basin, in Nova Scotia, where a smelting-furnace was about to be erected for the working of the iron ores of that district. There he collected the first Nova Scotian minerals that were brought to the United States. An account of them was published by him in "The Boston Journal of Philosophy and the Arts," and was reproduced, with some additions, in the American Journal of Science and Arts for 1827. During the summer of that year he, with his friend Dr. Charles T. Jackson, made a more extended mineralogical and geological exploration of Nova Scotia, extending over nearly three fourths of the area of the peninsula. The rich results of these joint labors were published in the fourteenth and fifteenth volumes of the American Journal of Science. In 1829 Mr. Alger and Dr. Jackson made another mineralogical exploration of the Province. Chartering a small vessel, they cruised along the coast of the Bay of Fundy, and obtained a very large supply of beautiful minerals. Specimens of these were freely distributed to all the public cabinets of Europe, and to many in this country, so that Nova Scotia became widely known as a country in which many rare minerals were found. In 1832 a new and augmented edition of the mineralogical paper by Messrs. Jackson and Alger, illustrated by a geological map and sections, and with sketches of interesting scenery, was published in the Memoirs of this Academy.

Several other valuable papers have been published by Mr. Alger, in the American Journal of Science, in the Journal and the Proceedings of the Boston Society of Natural History, and in the Proceedings of this Academy. The most noteworthy are: "Description of Remarkable Crystals of Gold from California, with Drawings," — a paper that has been more than once republished in Europe; "Description of the Zinc Mines of Sussex County, New Jersey"; "Notices of New Localities of Rare Minerals"; "Minerals of New Holland"; "Beaumontite and Lincolnite identical with Heulandite"; and a paper on the values and permanency of building-stones.

Wishing to republish the mineralogy of William Phillips, with additions bringing it up to the advanced state of the science, Mr. Alger most industriously collected the requisite materials, and performed the laborious work of revising this excellent book, so as to win the applause of mineralogists both in this country and in Europe. This more than editorial labor he performed mostly at night, after his usual mercantile tasks of the day were ended. Soon after the publication of this important work, in 1849, he received from Harvard University the honorary degree of Master of Arts. Mr. Alger intended to produce a new edition of his Phillips's Mineralogy, and had been engaged for years in collecting and digesting the materials. He had secured the donation of the inedited papers of Mr. Phillips, and also those of the late Professor Cleaveland, which he had carefully examined and collated; and his own collections for the republication were very extensive.

In addition to his mineralogical studies, Mr. Alger was much interested in the advancement of the mechanical arts. He invented an improvement in shrapnel, by which the shell was made to explode with greater certainty and with more deadly effect; and he was engaged with officers of the army in testing the merits of his invention when he was seized with the disease which suddenly terminated his useful life. He died at Washington, on the 27th of November, 1863, in the fifty-sixth year of his age.

Mr. Alger was one of the founders, and always an active member, of the Boston Society of Natural History, and he presented to that Society the first specimens of minerals that entered its cabinets. Mr. Alger was a most worthy and benevolent man, zealous in promoting the interests of religious institutions, full of patriotism and public spirit. His manners were gentle and retiring, and it was with great diffidence that he ever spoke in public. He was kind and considerate, and more apt to apologize for the shortcomings of others than to censure or expose them.

George Hayward, M. D., the son of Dr. Lemuel Hayward, of Boston, died suddenly, of apoplexy, October 7, 1863, at the age of seventy-two. He was graduated at Harvard College in 1809, and also received a Bachelor's degree at Yale College. Choosing the profession of his father, he received his medical degree at the University of Pennsylvania, in 1812. Subsequently he had the advantage, at that time rare, of visiting Europe, and of profiting by the instructions of Abernethy, Astley Cooper, and their contemporaries in England and France. On his return, he established himself in his native city, and succeeded to the practice of his father. With this, and an early election as Physician to the Almshouse, he soon gained a high professional position. He became a Fellow of the Massachusetts Medical Society in 1816, shared zealously in its councils during his long career, delivered its Annual Address in 1837, and was chosen its President in 1852, which office he held for several years. He was chosen Assistant Surgeon to the Massachusetts General Hospital, and was one of the Surgeons-in-Chief from 1838 to 1851, — a service of twenty-five years, — and one of the Consulting Surgeons till his death. " The history and records of the Hospital bear enduring testimony to his faithful and devoted labors in all these relations," say the Trustees ; who on his retirement complimented him with a request that he would sit for his bust in marble. From 1835 to 1849 he was Professor of Surgery in the Medical Department, and in 1852 was chosen a member of the Corporation, of Harvard University. He became a Fellow of this Academy in 1818. He was an active member of the New England Linnæan Society; was one of the founders of the Boston Society of Natural History, and its first Vice-President, and always maintained a lively interest in its welfare. For many years he was President of the Boston Athenæum, and was ever a liberal patron of science, art, and all liberal culture. When the Medical Commission of Massachusetts was established, to have a medical oversight of the militia, it was also constituted a Board of Examining Surgeons to decide upon the competency of surgeons for the army; and Dr. Hayward was selected as its chairman, which duty he performed until his death. In none of his various positions did he play an idle or secondary part. As a surgeon he was quick and confident in his decisions and in his operations. In some of the more delicate and unpromising operations he claimed to have originated processes which contributed essentially to their success. Though a few minor operations with the knife had preceded, it was his lot, as one of the surgeons at the Hospital, to perform the first capital operation (the amputation of a leg) under the anæsthetic effects of sulphuric ether, November 7, 1846, — a circumstance which he often alluded to with evident satisfaction. Both in this country and abroad, he strenuously and conscientiously advocated the claims of this agent over all others, on account of its absolute safety. As a teacher, he may not have been so brilliant as some others; but no one excelled him in presenting clearly the fundamental principles of his art, and in imparting sound practical instruction. He was ever zealous for the purity and dignity of his profession, was exceedingly intolerant of every form of empiricism, and was ever zealous in devising and promoting measures for the elevation of the true and the abasement of the false.

While in Europe as a student he began a translation of the writings of Bichat, which, together with the Supplement by Béclard, were completed and published in four octavo volumes, in 1818 – 23. This was the first introduction of the works of the French school to this country. In 1834 he published his "Outlines of Physiology." He was a frequent contributor to the medical journals, and in 1855 he republished many of his papers, with additions, under the title of "Surgical Reports and Miscellaneous Papers on Medical Subjects." All his writings were concise and explicit, and of a strictly practical nature. Among the more important were his "Surgical Reports on Cases and Operations at the Massachusetts General Hospital"; on "Diseases of the Knee-Joint"; on "Vesico-vaginal Fistula"; on "Anæsthetic Agents"; on the "Asiatic Cholera" (1832), in which he was one of the first to maintain, what is now generally admitted, the non-contagiousness of that disease; and an "Address to the Public on the Necessity of Legalizing the Study of Anatomy" (1831), in which he most effectively prepared the public mind for the enactment of a State law to that effect, which was passed quite in advance of any action in any other State of the Union.

JOHN WARE, M. D., died in Boston on the 29th of April, 1864. He was the son of the Reverend Henry Ware, for thirty-five years Professor of Theology in Harvard University, and was born in Hingham, Massachusetts, on the 19th of December, 1795. He was graduated at Harvard College in 1813, received the degree of Doctor of Medicine in 1816, and commenced practice in Duxbury; but in 1817 he removed to Boston, where he resided during the rest of his life. By the force of his excellent qualities and steady devotion to his profession, he gradually acquired an extensive and profitable practice. In 1832 he was appointed Adjunct Professor of Theory and Practice in the Medical Department of Harvard University, and on the resignation of Dr. James Jackson in 1836 he succeeded him in the chair, which he occupied until 1858. In 1848 he was elected President of the Massachusetts Medical Society, which office he held until 1852.*

Dr. Ware belonged to a family eminently distinguished for mental and moral endowments. His father was respected as a scholar and famous as a controversialist. His brother Henry, of whom he wrote a Memoir, was widely known as a preacher and theological writer, and had a decided poetical talent; his brother William, also much esteemed as a preacher, achieved an extended reputation by his classical novels "Zenobia" and "Aurelian." He himself showed a tendency to literary pursuits, one of his earliest publications being a work of imagination. But his life was given mainly to his profession, and his most important writings are connected with the history and treatment of disease. The Essay on Delirium Tremens had a signal influence. The description of the symptoms is very striking, and the views adopted go far towards reducing this affection, which had been thought by many to have found its specific in opium, to the category of self-limited diseases. The dissertation on Croup drew the distinction between the cases with membranous exudation, and those lighter maladies, often confounded with them, in so clear a way, that from the time of its appearance the vital difference between these forms of disease has been universally recognized amongst us. His observations with reference to hæmoptysis, based on long-continued observation of persons who had been subject to it, served to modify some of the sweeping conclusions which had been drawn from the wholesale observation of hospital cases. The style of these and all his writings is plain, easy, and without any affectation or display. He observed carefully, reflected maturely, and then, having fully made up his mind, recorded simply. In his oral teaching he was clear, minute, and explicit, thinking nothing of effect or eloquence, but only how to teach his pupils to know and to treat diseases. As a practitioner he came very near that golden mean where there is faith enough in remedies to leave no means untried that are likely to be useful, and distrust enough of all questionable agencies to guard against the abuse of powerful measures. None could fail to recognize his kindness, his gentleness, his conscientious devotion to the patient; so that the success which his professional skill deserved was made sure by his personal qualities.

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* The following is a list of his principal published writings: —

1823. Charles Ashton, a Story.
1833. Duties and Qualifications of Physicians. A Lecture.
1836. Remarks on the History and Treatment of Delirium Tremens. In the "Medical Communications of the Massachusetts Medical Society."
1838. An Appendix to this Essay, in the same publication.
1842. Contributions to the History and Diagnosis of Croup. In the "New England Quarterly Journal of Medicine and Surgery."
1843. Medical Education. A Lecture.
1846. Memoir of Henry Ware, Jr.
1847. Condition and Prospects of the Medical Profession. A Lecture.
1860. On Hæmoptysis as a Symptom. In the "Publications of the Massachusetts Medical Society."
1860. Philosophy of Natural History; being the last of a series of editions of Smellie, to which much important matter was added.

He also published an Essay on the Relations of the Sexes, and various other articles.

His great liberality and candor made him more freely eclectic and generously tolerant than many others whose observation is not more exact, and whose intellects are not clearer than was his own. He would sometimes listen where another might think he could employ his time better; but this was a proof of his fair and evenly-balanced nature, which was always patient with the convictions of others. The verdict of the whole profession to which he belonged, and of the community in the midst of which he lived and labored and died, is, that he was a good and wise man, worthy of love and honor and lasting remembrance. He was faithful to all his duties, a sound thinker, a devoted practitioner, an able writer and teacher; spiritually-minded, yet abounding in practical sense; with an intellect open to wide ranges of thought, yet willing to expend his life in the round of daily services traced out for him by his calling, — a man whose virtues were acknowledged by all who knew him, and who leaves behind him none but gracious recollections.

The Associate Fellows whom we have lost are Professor Joseph S. Hubbard, of Class I., Section 1; Major Edward B. Hunt, of Class I., Section 3; General Joseph G. Totten, of Class I., Section 4; and Dr. Francis Boott, of Class II., Section 2.

JOSEPH STILLMAN HUBBARD, well known for his efficient and thorough work in promoting the progress of astronomy in this country, died in New Haven, on the 16th of August, 1863. He was born in New Haven, September 7th, 1823, and received his education and formed his tastes for mathematical and astronomical pursuits in Yale College, where he was graduated in 1843. He was then for a short time engaged as an assistant in the High School Observatory in Philadelphia, under the distinguished astronomer, Sears C. Walker, and was subsequently employed in the reduction of the astronomical observations of the Rocky Mountain expedition under General Fremont. But it is with the annals of the Naval Observatory at Washington that his career as an astronomer and mathematician is chiefly associated. Appointed a Professor in the United States Navy in the spring of 1846, he was assigned to duty in this Observatory, which was then but recently established, and he remained at this post, a faithful and careful observer, for a period of seventeen years, until the time of his death. With the history and success of this Observatory Professor Hubbard's name is indissolubly connected. In the part which the Observatory took in the memorable discovery of the planet Neptune, it was his good fortune to verify by observation the happy conjecture of Sears C. Walker, that the planet had been observed by the astronomer Lalande as a fixed star, and that a particular star would be found to have disappeared from the place assigned to it in Lalande's Catalogue in 1795, more than fifty years before its discovery as a planet. The Annals of the Naval Observatory contain the chief part of the astronomical publications of Professor Hubbard. In addition to the regular work of an observer, he prepared, in conjunction with Professor Coffin, a valuable series of "Tables for the Reduction of the Places of the Fixed Stars," which were published in an appendix to the observations of 1847. He also prepared a useful table for facilitating the use of Gauss's formulas for ellipses and hyperbolas of which the eccentricities are nearly equal to unity. This was published in the Appendix to the translation of Gauss's *Theoria Motus, &c.*, by Commander (now Admiral) Davis. In all his work he manifested more solicitude for real excellence than for a temporary reputation. Domestic cares, straitened pecuniary resources, and a predisposition to social occupations rather than to severe studies, prevented him from employing to their fullest extent his powers as a mathematician and astronomer.

Beside his regular contributions to the publications of the Naval Observatory, he communicated from time to time the following papers to Gould's Astronomical Journal: "On the Orbit of the Great Comet of 1843," Vol. II., 1852; "Determination of the Orbit of Egeria," Vols. II. and III., 1854; "On the Orbit of Biela's Comet," Vols. III. and IV., 1856; "Correction of Logarithms of A, B, C, and D in the Tabulæ Regiomontanæ," Vol. IV., 1856. The articles in Appleton's American Encyclopædia on the Telescope and on the Transit-Circle are also from his pen.

EDWARD BISSELL HUNT, a distinguished officer of the United States Engineers, and a most promising man of science, was born at Portage, Livingston County, New York, June 15, 1822. He entered West Point in 1841, and was graduated June 30, 1845, standing second in his class. The next day he was appointed Brevet Second Lieutenant in the Corps of Engineers, and commissioned Second Lieutenant at the close of that year. On the 28th of August, 1846, he was appointed Acting Assistant Professor of Engineering in West Point, and he held that office for three years. Afterwards he was employed on several important fortifications, at Newport, New Haven, New London, &c. He rose by successive promotions to the rank of Major in the Corps of Engineers. At the outbreak of the rebellion he was engaged upon Fort Taylor, at Key West, which will ever stand as an enduring monument of his professional and scientific skill, and which was saved by his energy and sagacity from falling into the hands of the rebels. From 1851 to 1857, while stationed on the New England coast, in the service of the Corps of Engineers and the Light House Board, he also rendered large services to the Coast Survey, and through that work to the general cause of physical science.

He died on the 2d of October, 1863, while experimenting near Brooklyn Navy Yard upon his own invention for piercing the armor of iron-plated ships. Through some accident, the gun-room was filled with the gases from a burning shell, and upon his entering it by a ladder, he was suffocated before effectual help could be rendered.

Major Hunt's personal appearance corresponded to the character of his mind: a noble strength and directness of address, great modesty combined with perfect self-possession, purity, and kindness of heart, were recognized in him at sight. A closer acquaintance showed that culture had given him also a command of at least all the ordinary resources of the calculus, and that in the investigation of physical and other problems he displayed not only a sound common-sense, but a close metaphysical acumen, which rendered his papers as interesting to the philosophical reader as they were valuable to the man of science. His last publication was an ingenious induction, on scientific grounds, of the perpetuity and perpetual unity of that nation to whose service he had given his powers, and in whose service he finally sacrificed an unexhausted life. A partial list of the papers published by Major Hunt, hereto appended, will show how earnestly, amid the constant duties of his profession, his mind turned toward scientific problems.*

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* On the Dispersion of Light. — Am. Journ. Sci., N. Ser., Vol. VII., May, 1849.

On the Interpretation of Mariotti's Law. — Am. Journ. Sci., Vol. IX., May, 1850.

Remarks on Terrestrial Thermotics. — Am. Association for Advancement of Science, Aug., 1849.

Proposed Experiments on the Cohesion of Liquids. — Am. Ass., Aug., 1850.

On the Use of Air as a Medium for Conveying Mechanical Power. — Am. Ass., Aug., 1851.

Proposal for a Trigonometrical Survey of New York. — Am. Ass., Aug., 1851.

Views on the Nature of Organic Structure. — Am. Journ. Sci., Vol. XIII., Jan., 1852.

Remarks on the Proposed Geographical Survey of New York. — Am. Journ. Sci., Vol. XIV., July, 1852.

On Cohesion of Fluids, Evaporation, and Steam-Boiler Explosions. — Am. Ass., July, 1853.

Remarks on Lithography and Lithographic Transfer. — Am. Ass., July, 1843.

The Conical Condenser; a Telescopic Appendage. — Am. Journ. Sci., Nov., 1853.

Project of a Geographical Department of the Library of Congress. — Am. Journ. Sci., Vol. XVI., Nov., 1853.

Report of Engraving Operations for 1853. — Coast Survey Report for 1853.

Letters describing an Instrument, invented by himself, and called the Interranger. — Coast Survey Report for 1853.

Description of the Self-registering Tide-Gauge. — Coast Survey Report for 1853.

Notes on Map-Projections. — Coast Survey Report for 1853.

Description of the United States Coast Survey Apparatus for Measuring Base Lines. — Am. Ass., May, 1854.

On the Nature of Forces. — Am. Journ. Sci., Vol. XVIII., Sept., 1854.

Notes on Map-Projections. — Am. Journ. Sci., Vol. XVIII., Nov., 1854.

Report on Engraving in Relation to the Coast Survey. — Coast Survey Report for 1854.

JOSEPH GILBERT TOTTEN, late the veteran head of the United States Engineer Corps, died at Washington, on the 22d of April last. He was born at New Haven, Connecticut, on the 23d of August, 1788, entered the United States Military Academy at West Point in 1803, as one of the thirteen cadets of which the school then consisted, and

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General List of Coast Survey Discoveries and Developments to 1853 inclusive. — Coast Survey Report for 1854.

Condensed Alphabetical Index of the Ten Annual Coast Survey Reports, from 1844 to 1853 inclusive. — Coast Survey Report for 1854.

On the Use of Salt Marsh Sods for Facing the Steep Slopes of Parapets, Terraces, &c. — Am. Ass., August, 1855.

On an Index of Papers on Subjects of Mathematical and Physical Science. — Am. Journ. Sci., Vol. XX., Nov., 1855.

On our Sense of the Vertical and Horizontal, and on our Perception of Distance. — Am. Journ. Sci., Vol. XX., Nov., 1855.

On Efflorescence from Brick Masonry. — Am. Ass., August, 1856.

On Systematizing the Abbreviations of Titles of Periodicals, Transactions, &c., Am. Ass., August, 1856.

Report of an Index of Reference to Memoirs and Papers on subjects related to the Coast Survey Operations. — Coast Survey Report for 1856.

On the Idea of Physical and Metaphysical Infinity. — Am. Journ. Sci., Vol. XXV., Jan., 1858.

Views and Suggestions on the Practice and Theory of Scientific Publication. — Am. Journ. Sci., Vol. XXVI., July, 1858.

Notes on a New Sounding Apparatus proposed by himself for Coast Survey Use. — Am. Journ. Sci., Vol. XXVI., Sept., 1858.

Report on the Preparation of an Index of Scientific References. — Coast Survey Report for 1857.

On the Dynamics of Ocean Currents. — Am. Jour. Sci., Vol. XXVII., March, 1859.

On some Anomalies in the Florida Gulf Stream, and on their Further Investigation. — Am. Journ. Sci., Vol. XXVII., March, 1859.

Description of the new Portable Coffer Dam. — Am. Ass., Vol. XIV., Aug., 1860.

New Method of Preventing Fire-Damp Explosions in Collieries, by Lighting with Coal Gas. — Am. Ass., Vol. XIV., Aug. 1860.

Modern Warfare: its Science and Art. — New Englander, Vol. XVIII., Nov., 1860.

Union Foundations: a Study of American Nationality as a Fact of Science. — Pamphlet published in New York, Jan., 1863.

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was graduated in 1805, receiving the commission of Second Lieutenant of Engineers on the first of July of that year.

He soon resigned from the Corps of Engineers to take the position of Assistant to his uncle, Professor Jared Mansfield, who was then Surveyor-General, and had in charge the first systematic survey of the Northwestern Territory, which at that period included the present State of Ohio. The impress of young Totten's military education, however, remained. He returned to the Corps in February, 1808, and during the ensuing war with Great Britain went through a distinguished career. He was Chief Engineer under Major-General Macomb, in the campaign of 1814, on the northern frontier of New York; and he won the brevet of Major, September 11, 1814, "for gallant conduct at the battle of Plattsburg." In September, 1824, he was brevetted Colonel; in 1838, he was commissioned. As Chief Engineer he accompanied Major-General Scott to Mexico, and was brevetted Brigadier-General, on the 29th of March, 1847, "for gallant and meritorious conduct" at the siege of Vera Cruz. Just before his death, the President of the United States nominated him to the Senate as a Major-General, and that body immediately confirmed the nomination.

Thus General Totten's whole life, from his sixteenth year to the seventy-sixth, was chiefly devoted to the Engineer service of the United States. "In that period, and especially in the last few years of his life, he made many experiments in the leading elements of his profession; amongst others, on the penetrability of walls by the force of cannon-shot, bringing engineers back to consider the use of a well-known fact, namely, that earthen profiles were more sure and more lasting resisters of heavy projectiles than masonry."

Among his excursions from the domain of military engineering were the examinations of the growth of the sandy coast-line of the Southern States of the Union on the Atlantic and Gulf of Mexico; the use of jettees to control the growth of the coast; the complex changes of harbors and shores; the preservation of islands, of river shores, of wharves, etc., from encroachment, as at Portland, Boston, New York, Cape Fear Entrance, Charleston, Fernandina, Pensacola, and Mobile. For these labors, executed without remuneration, he received the thanks of the Legislature of New York, of the City Councils of Portland and Boston, and of the Board of Trade of New York.

Next to his own profession and to the studies incident to it, his attention was most attracted to natural history, and especially to conchology, geology, and mineralogy. Fond of exercise and of occupation, bodily and mental, he made his walks and drives both conducive to his robust health and subservient to these scientific pursuits, in which he accumulated a large amount of knowledge, and evinced powers of observation and research of no common order. His genial nature always inclined him to place at the disposal of others, and especially of the assistants under his command, all the treasures and resources which he had garnered; and this was done more in the spirit of the elder brother, or head of a family, than as a superior officer. His personal influence and example stimulated and led on to improvement the educated young men who from time to time came into his military family. He marked out or suggested to them subjects of research, mostly of a practical kind, and methods of experiment; and always encouraged any disposition in them towards originality of thought; and so freely and generously imparted his own conceptions to his assistants while stimulating theirs, that they might well have been persuaded that many of the ideas originated with themselves. His laboratory was at their service, no less than his example and companionship. An enumeration of his principal professional researches, could they here be given, would illustrate the mental thoroughness, the complete devotion, and the eminently practical character of this excellent and genial man.

General Totten was elected, first by Congress, one of the Regents of the Smithsonian Institution at its foundation in 1846, and was continued in the Board of Regents by successive elections held every sixth year thereafter. During the entire period he was constant in his services as a member of the Executive Committee of the Board. He was also a member of the Light-House Board created by Congress in 1852, and one of the most useful of its working members, as Chairman of the Committee of Engineering and of Finance.

" For the past twenty-six years he has been at the head of the Engineer Department, administering with untiring devotion, spotless integrity, and signal ability, the varied duties, the financial responsibilities, and the professional labors of that arm of service, so essential to our national defence."

FRANCIS BOOTT, M. D., — whom we claim as a New England naturalist, although elected into the Academy long after he took up his residence in London, — died in that city on Christmas last, in the seventy-first year of his age. His father, Kirk Boott, who came from

England in early life, was a well known and successful Boston merchant. His brother, Kirk Boott, Jr., was one of the pioneers of the manufacturing enterprise at Lowell. Francis Boott, the third son, was born in Boston on the 26th of September, 1792; was graduated at Harvard College in 1810; passed the four succeeding years in England; and, returning to this country in the year 1814, with his scientific tastes awakened, he was mainly occupied for the next six years in investigating the botany of New England. In the summer of 1816, he, in connection with Dr. Bigelow, undertook the botanical exploration of the higher mountains of New England, and in one tour ascended Wachusett, Monadnock, Ascutney, and Mount Washington, the latter at that time to be reached only by a laborious journey of two days on foot. They were accompanied upon this at that time formidable expedition by our late associates, Chief Justice Shaw and Francis C. Gray. An interesting account of the ascent of Mount Washington was published at the time in the New England Journal of Medicine and Surgery, by Dr. Bigelow, now the sole survivor of the party.

In the year 1820, at the age of twenty-eight, having determined to adopt the medical profession, Mr. Boott crossed the Atlantic for the last time, and, proceeding to London, became a pupil of the late Dr. Armstrong. He continued his medical studies in the University of Edinburgh, where he took the degree of M. D. in 1824. He then went to Paris for a year, studying in the schools of medicine and of natural history, and forming the acquaintance of the eminent French naturalists of that period. He soon after established himself in London as a physician, and also as Lecturer on Botany and Materia Medica in the Webb Street School of Medicine, in connection with his preceptor and near friend, Dr. Armstrong. Upon the early death of Dr. Armstrong, he became his biographer and expositor, and published in 1834, after several years' preparation, in two octavo volumes, his "Memoir of the Life and Medical Opinions of John Armstrong, M.D., to which is added an Inquiry into the Facts connected with those Forms of Fever attributed to Malaria and Marsh Effluvium," — a work which excited considerable attention. He had before published two Introductory Lectures on Materia Medica. He was an active promoter of the establishment of the London University (now University College), and was for more than a quarter of a century an influential member of its Senate and Council. He had been elected a Fellow of the Linnæan

Society as early as in the year 1819, under the Presidency of its founder, his friend, Sir James Edward Smith; and afterwards he served it continuously for the last twenty-five years of his life as Secretary, Treasurer, or Vice-President. Nearly thirty years ago he was offered the vacant Chair of Natural History in Harvard University. But the ties of family and of a large circle of attached friends bound him to England. About this time, gradually relinquishing medical practice, he began to devote himself to the study of the intricate genus *Carex*, one of the largest and most difficult genera of the vegetable kingdom. This genus, so admirably illustrated by Schkuhr at the beginning of this century, has since attracted the particular attention of American botanists, as is shown by the caricological writings of Muhlenberg, Schweinitz, and of our surviving associates, Dewey and Torrey. But since the publication of Dr. Boott's account of the British-American Carices, in Sir William Hooker's *Flora Boreali-Americana*, in 1840, he has been the unrivalled head of this department. In his principal work, entitled "Illustrations of the Genus Carex," he has accomplished for this genus, now that its known species are nearly six hundred, what was done by Schkuhr half a century ago, when less than a quarter of these species were known, and has done it upon a far grander scale, and with unparalleled fulness of illustration. Three folio volumes of this great work, with over four hundred plates, have been produced within the last six years; and a fourth volume, left incomplete when his long enfeebled strength finally gave way, is about to be published by his family. To this work Dr. Boott devoted not only many years of assiduous labor, but a large sum of money; the drawings, engravings, and letter-press having been produced at his sole expense, while the larger part of the copies have been freely presented to those, both in Europe and in this country, who were most interested in the subject. It has, therefore, been well said to be "one of the most munificent contributions ever made to scientific botany, besides being one of the most conscientious and scrupulously accurate, — on which account it certainly entitles its author to take a much higher place among botanists than that of an amateur, which is all his modesty would allow him to lay claim to."

Modesty, scrupulous accuracy, entire disinterestedness, a winning simplicity and cordial frankness, were characteristics of Dr. Boott. Most of our naturalists and professional men who have visited England within the last thirty years can testify to the kind, even affectionate interest which he took in them, and in the furtherance of their pursuits. His published works will suffice to secure for his name an honorable and permanent place upon the records of science. But only his contemporaries and friends will know how much he has done to help others, and how disinterestedly and gracefully that aid was ever rendered.

The Foreign Honorary Members whose eminent names now disappear from our roll are Baron Plana, Professor Mitscherlich, Professor Henry Rose, Jacob Grimm, and Archbishop Whately. To these must be added the name of the eminent Russian mathematician, Ostrogradsky, of whose death during the preceding year the Academy was not informed until after the last Annual Meeting.

Baron GIOVANNI PLANA, Senator and Director of the Royal Observatory at Turin, died on the 20th of January last, at the age of eighty-two.

He was born at Voghera, Piedmont, November 8th, 1781, but removed to France in his childhood. He entered the *École Polytechnique* at Paris in 1800, taking the rank of eighth among the candidates admitted. The instructions and influence of Monge, of Lagrange, Laplace, and Legendre, must have contributed powerfully to determine the direction given to his powers, which afterwards proved him no unworthy successor of these illustrious men. While yet very young, he received an appointment as Professor in the Military School of Alessandria, near his native town. Subsequently he became Professor of Astronomy and of the Higher Mathematics in the University of Turin, Director of the Royal Observatory, and President of the Academy of Sciences. In 1821 – 23, he was associated with Carlini in the measurement of the arc of the meridian in Savoy and Piedmont. The account of the plan and execution of this work, prepared by Plana, received the Lalande prize of the French Institute.

The numerous memoirs given to the world by Plana during his long and active career, embracing a great variety of investigations in the more difficult departments of physics, pure mathematics, and astronomy, testify to the versatility of his talents, and the unwearied industry with which they were exercised. Everywhere the treatment is by the hand of a master, and the subject receives some important advancement; yet it did not fall to his lot to attach his name to any of those brilliant discoveries which are the foundation of scientific fame. In point of number, his researches in astronomy, even including those upon subjects only indirectly related to the science, would perhaps furnish the titles of scarcely the half of his published writings; but they include those by which his name has been most widely known. His celebrated criticisms upon the theory of the planetary perturbations, as developed in the *Mécanique Céleste*, where he boldly called in question the authority of Laplace upon a subject which had afforded to that renowned geometer one of the most brilliant of his triumphs, were alone sufficient to show his confidence in his own powers, and to place him in a position of prominence before the scientific world which only abilities of the highest order could have sustained; nor was this the only occasion on which he exercised great freedom of criticism in charging theoretical errors upon the same author.

His attention seems to have been early directed to the Lunar Theory. Already in 1813 he was seriously contemplating its discussion in conjunction with Carlini. The principle on which it was proposed to conduct this discussion may be designated as the *literal* solution of the problem, where the coefficients of the inequalities are expressed in theoretical form, in contradistinction to the *numerical* solution, in which they are derived from observation. Plana zealously maintained the former method to be the only solid basis of the Lunar Theory, even carrying the fervor of his advocacy to the extent of characterizing the rival system, exhibited in its highest perfection in the Lunar Tables of Hansen, as "un pas rétrograde sous le rapport de la théorie."

In 1820, a prize, suggested by Laplace, was announced by the Institute for the construction of Lunar Tables, so far as possible, from theory alone. This was adjudged in 1828, by a commission consisting of Laplace, Burckhardt, and Poisson, to be divided between Plana, Carlini, and Damoiseau. The memoir of Plana and Carlini has never been published, but it was probably incorporated, to a considerable extent, in the "Théorie du Mouvement de la Lune," published by Plana in 1832, — a monument of genius and of the most indefatigable industry, triumphing over difficulties of which, to use his own words, it is impossible to form the least conception "sans avoir soi-même parcouru l'immense océan qui sépare le point de départ et le point d'arrivée."

A supplement to the "Théorie de la Lune" appeared in 1857; and he was still vigorously prosecuting, in his eightieth year, the investigations entered upon almost half a century earlier. Even at a still later period he was actively engaged in profound scientific labors, the announcement of his latest memoirs scarcely preceding the intelligence of his decease. Few more striking examples have occurred of the preservation and the advantageous employment of intellectual powers of the highest order so far beyond the ordinary term of human life.

The two renowned chemists, whose names are now removed from our list, Mitscherlich and Rose, are naturally associated. They were born nearly at the same time, studied together under the same master, were Professors throughout the greater part of their lives at the same University, and died within a few months of each other. But with all these external coincidences in the character of their minds and in their influence upon science, they were widely different; so that, had either been longer spared to us, he would in no wise have made good the loss of the other.

EILHARD MITSCHERLICH died on the 28th of August, 1863. He was born in 1794, in Neurede, a small town near the German Ocean, in the Province of East Friesland, at that time belonging to Prussia. He finished his chemical studies at Stockholm, in the laboratory of Berzelius, and was shortly afterwards, in 1822, made Professor at the University of Berlin. He here published, in 1829, a text-book upon Chemistry, — a work of much originality, and which has retained its reputation to the present day.

Mitscherlich's attention was early directed to the connection between crystalline form and chemical composition; and he had the singular fortune, in his twenty-fifth year, to discover the law which expresses their relation. With this discovery his name has become identified; and in turn it seems to have given the direction to his thoughts and to the more important of his works. As is usually the case, the way to this discovery was already prepared by the labors of others. It had been laid down by Haüy as a law, that, with the exception of those substances which crystallize in the regular system, a difference in chemical composition must necessarily be attended by a difference in crystalline form; and it was thought impossible that the same body could assume two distinct primitive forms. The truth of the former of these views was contested by numerous observers about the beginning of the present century. It was shown as early as 1787 by Leblanc, that from a solution containing the sulphates of iron and of copper crystals may be obtained which have precisely the same form, and yet contain the two salts in very different proportions. And Bernhardi, while agreeing with Haüy that each substance can assume but *one* primitive form, admitted that different substances may possess the *same* primitive form; and also, that a body may have the power to impress upon another with which it is mingled its own peculiar crystalline shape. Finally, in his theory of "vicarious constituents," — bodies which are capable of replacing each other in combination without thereby inducing a change of form, — Fuchs had made a near approach to the theory of Isomorphism.

It remained for Mitscherlich, by collating and generalizing the views of those who had gone before him, and by largely adding to the facts which they had accumulated, to develop this law; nor did he at first perceive it in its true light. In his second memoir Mitscherlich says: "Do different elements take the same crystalline form when combined with the same number of atoms of one, or of several other elements? Is identity of crystalline form dependent solely upon the number of atoms? Is it independent of the chemical nature of these atoms? Accident leading me at first to investigate a series of compounds which answered all these questions in the affirmative, I was on the point of regarding my results as a general law. But on extending my researches to other combinations, . . . I found that this identity does not necessarily follow." And he was finally led to the view that "certain elements, when united with the same number of atoms of one or of several elements, assume the same crystalline form; and that the elements may in this respect be divided into groups."

If to this be added the property of the elements in the several groups to replace each other in varying proportions in a compound, without materially changing its crystalline form, we have the true expression of the law of Isomorphism.

The discovery of Isomorphism showed that the first axiom of Haüy was inexact, and required an essential modification; the discovery of Dimorphism, made at the same time, completely overturned Haüy's second axiom. It is a proof of the sagacity displayed by Mitscherlich in these researches, that, in the long time which has elapsed since they were made, his deductions have received no important alteration; even his own genius could in after life only add to the facts upon which the conclusions arrived at in his youth were founded. The importance of his results to chemistry and mineralogy was at once appreciated; while their very brilliancy has obscured his subsequent works.

HEINRICH ROSE died at Berlin, on the 28th of January last. Nearly half a century of Professor Rose's life was devoted to the unremitted and successful cultivation of pure science. In attempting to form an opinion of any one scientific work so long ago completed, we find a difficulty in representing to ourselves the circumstances under which it was composed, — in rightly apprehending the state of science at the time. The difficulty is still greater of forming a correct idea of what would have been the present state of chemical science, had labors like those of Rose, on the most varied subjects, and extending through a long lifetime, never been undertaken. Few of these works led to great or brilliant discoveries; most of them resulted in those gradual additions to knowledge which necessarily follow a patient and well-directed course of inquiry. But it is precisely to such labors, which have prepared the way and the age for the reception of great truths, that science is in the end indebted for their discovery.

Heinrich Rose was born at Berlin on the 6th of August, 1795; consequently, at his death he had not completed his sixty-ninth year. His father and grandfather were apothecaries and chemists in Berlin; the latter a man of considerable reputation, and the discoverer of the fusible alloy which goes by the name of Rose's Metal. In the discourse which H. Rose delivered before the Berlin Academy, in memory of Berzelius, he tells us: "I had the good fortune in my youth to assist the celebrated Klaproth in his chemical operations, but only in the last years of his life, in the summer of 1816, when his labors were interrupted by frequent and severe illness."

In 1819 Rose went to Stockholm, and worked for a year and a half in the laboratory of Berzelius.

In 1823 he was appointed Professor of Chemistry in the University of Berlin; and he retained and fulfilled the duties of this station until his death.

The writings of Rose consist of his Treatise on Analytical Chemistry, and of a very great number of papers published at first in Gilbert's, and then in Poggendorff's Annals. His Analytical Chemistry is the work by which he is best known. Without claiming to be a treatise upon the theory or the operations of chemistry in general, it includes them both, so far as they are required for the purposes of analysis. From its precision and completeness it not only superseded all the earlier works on this subject, but even caused them to be forgotten. Of his papers, some are single essays, devoted to special points of chemistry; others, of a more general nature, and extending in series through one or more volumes of the Annals, are researches upon the composition of, or the reactions which characterize, different groups of chemical compounds. So various, indeed, are these subjects, that there is hardly an element for some portion of our knowledge of which we are not indebted to Heinrich Rose. It is therefore impossible to give an analysis of works whose mere titles would require more space than is allotted by custom to the memory of our distinguished associates. Much of what was afterwards arranged in its proper place in his Analytical Chemistry, appeared originally as contributions to the Annals.

The most remarkable of these papers is a series which extends, with interruptions, through more than fifteen years, and contains the history of his discovery of the metal Niobium. The points of interest of this investigation are obscured by its great detail, and by the repetitions, and sometimes inconsistencies, inevitable in a work prosecuted at long intervals. From the different specific gravities of the several varieties of the mineral called Tantalite, as well as of the metallic acids contained in them, Rose was led to believe that these acids were the oxides of different metals. He at first assumed the existence of two new metals, which he called Niobium and Pelopium, and which, by uniting with oxygen, gave rise to the niobic and pelopic acids. Further examination showed, however, that these acids contained but one metal, which was combined in them with different proportions of oxygen. But the one of these acids could in no way be directly converted into the other; they comported in so many respects like the oxides of two similar but different metals, that for a long time he so regarded them. The metal obtained from these acids is the same, whether the one or the other of them has been employed; but when the metal is again oxidized, there is formed always the one, never the other, of the two acids. When the metal from either of the acids is made to combine with sulphur, which it does in several proportions, and the resulting sulphuret is reconverted by oxidation into acid, the acid is invariably the same as that from which the sulphuret was formed. "This is a phenomenon," says Rose, "to which there is no analogy in chemistry. For the two acids act, not like the oxides of one and the same metal, but like oxides of two different metals. The tendency to the formation of the one or the other of the acids must have existed beforehand in the metal itself. The inquiry had touched upon ground which is as yet hidden from us by an impenetrable veil; and this it is which has led me to devote so much labor and time to the subject."

The discovery of a new element is apt to be attended with an *éclat* which its scientific importance does not always warrant. The combinations of the niobic and pelopic acids have little chemical interest, and they are found in such small quantities that few chemists can have the opportunity of investigating them. It was not until Rose had shown that these supposed new bodies were two forms of one and the same element, differing from each other as no two forms of the same matter were known to differ, that the real importance of his discovery was made evident, and that he was rewarded for those years of persevering and sagacious research. To the close of his life, and under the trial of domestic affliction, Rose's interest in science remained unabated. In his last years, and apparently conscious that his life was not to be much prolonged, he published a series of papers under the title of "Contributions to Analytical Chemistry." They contain the results of his latest experiments, and his views upon several points of this his favorite subject. His latest work appeared only a few months before his decease. Not inappropriate to Rose himself are the words with which he concludes his notice of the life of his master, Berzelius: "The labors of such men present to us the true model of the man of science."

JACOB GRIMM, the venerable German philologist, was born at Hanau, January 4, 1785. He was educated in the Lyceum at Cassel, and afterwards in the University of Marburg, where he studied law under Savigny. He did not, however, engage in professional life as a jurist, but devoted himself with passionate ardor to the study of mediæval literature and antiquities, especially those of his own country. For a number of years his studies were more or less interrupted by public employments. In 1814 he was appointed Hessian Secretary of Legation, and in that capacity attended the Congress of the Allied Powers at Vienna. But from this time forward he renounced political life, except that, more than thirty years later, in 1848 and 1849, he was a member of the National Assembly in Frankfort and Gotha. From 1816 to 1829, he was Second Librarian at Cassel. From 1830 to 1837, he was Professor and Librarian in Göttingen. When the King of Hanover set aside the Constitution which had been given to his subjects, he was one of the seven Professors who protested against the act, and in consequence was not only deprived of his office, but, with

Gervinus and Dahlmann, was banished from the country. After four years spent in retirement at Cassel, he was called to Berlin in 1841, as Member of the Academy, with the privilege of lecturing in the University. In these changes of residence and service, he was accompanied by his brother Wilhelm, who was but one year younger than he, and who shared, though with a less vigorous and ardent nature, in the same studies and pursuits. A few years after coming to Berlin, they commenced in common the gigantic undertaking of a German Dictionary, to contain all words found in German literature since the era of the Reformation, with definitions and copious citations.

While they were engaged in this work, Wilhelm Grimm, after a few months of declining health, died, December 16, 1859: he was commemorated by his brother in a pathetic address delivered before the Berlin Academy. For nearly four years longer, Jacob Grimm continued to work on by himself, in an old age of more than seventy-five years, but with hardly any abatement of activity and power. At length the call of death came unexpectedly: a stroke of apoplexy terminated his honorable and useful life, September 20, 1863, in the seventy-ninth year of his age.

In the scientific career of Grimm we may trace the patriotic reaction caused in the mind of Germany by the conquests of Napoleon. His studies and labors were comprehensive and multifarious; but Germany was the centre of them all. It was not, however, Germany in the narrow sense that engaged his attention: his interest extended to all sections and members of the Germanic race. They are all represented in what we must regard as the great work of his life, the "Deutsche Grammatik," of which the first volume was published in 1819, and the fourth in 1837; a fifth, which was to complete his plan, never appeared. It is a work of prodigious research, containing an immense amount of scientific material, which had to be collected by the author himself, with scanty help from previous laborers in the field. It is no less distinguished for the originality and boldness of its conception. No scholar had before produced a comparative grammar, embracing a number of related languages, and showing how the same primitive scheme of inflection and structure presents itself in each. It is difficult to overestimate the acuteness and sagacity which enabled Grimm to trace out a unitary system amid the seeming irregularity and confusion of the phenomena he had to deal with. In his "Geschichte der Deutschen Sprache" (2 vols., 1848), the lights of philology are used to explore the darkness of German antiquity, to show the early civilization, settlements, and migrations of the Germanic races. Of his "Deutsches Wörterbuch" we have already spoken; though the master's hand was arrested in the middle of his work, it is hoped that his collections of material will fall to successors who, working in his spirit and with the guidance of his example, will worthily complete this great monument of his genius and learning.

But Grimm was no mere student of words. To him grammar and lexicography were means, not ends. He saw manifested in them the mind of the German people; and all manifestations of the Germanic mind attracted his attention and awakened his sympathy. This we see in many extensive and laborious works which issued from his study, such as his "Deutsche Rechtsalterthümer" (1828), his "Deutsche Mythologie" (1835), his "Deutsche Weisthümer" (3 vols., 1840-42), and not least in the "Kinder- und Hausmärchen," published jointly by himself and his brother Wilhelm, which has endeared their names to the children of all countries. A strong poetic sensibility was among the characteristics of Grimm's mind. He loved the old German poetry, and read it again and again with the keenest relish. In publishing the remains of the early German literature, he rendered important service by his "Reinhart Fuchs" (1834), his Anglo-Saxon "Andreas und Elene" (1840), his "Gedichte des Mittelalters auf König Friedrich I." (1844), etc.

These and other important works, such as his numerous papers published in scientific and literary journals, and in the transactions of learned societies, — papers always characterized by great ingenuity and laborious research, — may serve to show that it is no empty vaunt when Grimm says of himself that there is in his nature a certain iron industry. At the same time, it is clear that no industry, however tough and plodding, could have accomplished such results, without the qualities of quickness and acuteness, which Grimm possessed in a high degree. His acuteness was conspicuous in his conversation, which is described as singularly pithy and racy, full of unexpected turns and striking suggestions. His quickness also was extraordinary. His books were written with great rapidity, and were printed just as they were written, without first draught and corrected copy. Composed in this way, they are of course wanting in literary finish. They have not the simplicity and transparency which can only come by careful elaboration.

RICHARD WHATELY, D.D., Archbishop of Dublin, died at his official residence, October 8, 1863, aged seventy-six years. He was born in London, and educated at Oxford, where he received his first degree in 1808. Three years afterwards, he was elected a Fellow of Oriel College, an institution which then became, under the able management of its Provost, Dr. Coplestone, the most distinguished school of speculative philosophy in England. Among Whately's contemporaries or immediate successors there were Davison, Hampden, Hawkins, Keble, Arnold, the elder Newman, and Pusey; and he was wont to allude with commendable pride to the fact, that there were, at one time, no less than seven Bishops of the Established Church, viz. four English, two Irish, and one Colonial, who had been members of this one small College. Vacating his fellowship by marriage in 1821, he became Rector of Halesworth, in Suffolk; but his admirable qualifications for academic life and labor were already so well known, that, after only four years' absence, he was recalled to the University by an unsolicited appointment as Principal of St. Mary's Hall. In this position he remained till 1831, when Earl Grey, then Prime Minister, appointed him Archbishop of Dublin, believing that he was the fittest person in the United Kingdom, not only to take the lead in the Irish Church, but to forward the great scheme of National Education in Ireland, and, as an indispensable preliminary to its success, to establish more amicable relations between Catholics and Protestants in that divided country. This was an enterprise hedged round with peculiar difficulties and perils; but through Dr. Whately's discretion, energy, and perseverance, it was successfully carried forward for over twenty years. He showed a rare union of literary talent, knowledge of human nature, and administrative ability; and the work that he accomplished places him in the highest rank of Christian statesmen.

The published writings of Archbishop Whately were numerous, and upon a great variety of topics. He was almost equally distinguished as a theologian, and as a writer upon the Evidences of Christianity, and the sciences of logic, rhetoric, and political economy. In theology, though he cannot be called the founder of a school, he was an independent and original thinker, always inclining to the side of liberal opinions, but prompt and efficient in the advocacy of all which he regarded as constituting the essential doctrines of his Church. His "Essays upon some of the Peculiarities of the Christian Religion," "On some of the Difficulties in the Writings of the Apostle Paul," "On the

Kingdom of Christ," and in refutation of Tractarianism, have had a wide influence upon the course of religious thought in England for more than a quarter of a century. His "Treatise upon Logic" attained an unexampled circulation both in England and this country, and was the chief means of rescuing the study of that science from the neglect in which it had languished for nearly two centuries. The corresponding treatise upon Rhetoric has almost equal merits; while the admirable little text-books on "Money Matters," "The Evidences of Christianity," and "The British Constitution," which he prepared for the use of the Irish National Schools, are the productions of a Christian philosopher, filling one of the highest offices in the Church, who was not too proud to assist in teaching the humblest of the poor. It ought not to be forgotten, also, that he was even munificent in his charities, though his income was but scanty for an Archbishop, and that he was wholly disinterested in bestowing his patronage, giving but a very modest preferment to his only son.

The great popularity and influence of his writings are attributable in a considerable degree to the merits of his style, which has often been compared with that of Paley. It is clear, unpretending, and forcible, abounding with homely but apposite illustrations, which have frequently the effect of wit. He appears more as a teacher than an author, repeating the truths which he deems important over and over again in his different works, and always more regardful of the effect to be produced, and the principles to be inculcated, than of what might be thought of his own manner and intentions. His own character peeps out in an unconscious and amusing manner, especially in his later works, but always in a way to command the respect, and even the affection, of his readers. He manifests perfect simplicity and heartiness, and that sort of good nature which the French call *bonhommie;* he quotes his own writings frequently, and is so eager to impress upon others the doctrines which he thoroughly believes and deems of the highest interest, that his manner might sometimes be chargeable with dogmatism. He was a thinker, rather than a great scholar; the truths which he was most anxious to present were not those which he had found in books, or which related to the interpretation or the enforcement of other people's thoughts, but those which he had evolved from his own researches and meditations, and on which he had dwelt so long that they assumed in his eyes what was perhaps an exaggerated importance. He acquired that influence in his Church, in his own diocese, and over his contemporaries generally, which never fails to attend the efforts of a disinterested and indefatigable worker, who is eager to impart to others the convictions which have strongly affected his own mind and conduct.

Perhaps Dr. Whately overestimated the importance of mere reasoning, — of holding up truth in the clearest light and supporting it by the most convincing arguments. He was always a logician, aiming much more to convince than to persuade. Even rhetoric, according to his acceptation of the term, was not much more than a department of applied logic, or a science of the discovery and right use of arguments. Of mere oratory he was impatient, and had only a feeling of contempt for fine and eloquent writing. He was a Christian Rationalist, in the highest and best sense of that term, always aiming to furnish a reason for the faith that was in him. He accomplished enough to leave behind him the reputation of which he himself would have been most desirous; — that of an author whose writings have contributed largely to the instruction and improvement of his countrymen; and of a prelate whose name will long be honored, not only in his own Church, but by all Christian denominations, for the liberality of his opinions, and for his successful advocacy of religious truth and exemplification of it in his own life and character.

A list of the members of the Academy, arranged under their several sections, and corrected up to the present date, is appended to this report. It appears that there are now one hundred and seventy Resident Fellows, seventy-eight Associate Fellows, and seventy-one Foreign Honorary Members.

In conclusion, the Council submitted nominations to fill vacancies in the list of Foreign Honorary Members made by the decease of MM. Plana, Ostrogradsky, and Rose.

The Annual Report of the Treasurer, attested by the Auditors, was read, accepted, and ordered to be entered on the records. On motion of the Treasurer the following vote was passed: —

"Whereas certain banks in which the Academy owns stock have become, or are about to become National Banks, our Treasurer is hereby authorized to exchange said stock for equal amounts of stock in the said National Banks respectively."

The Treasurer in behalf of the Finance Committee recommended that the same appropriations as for the preceding year be made from the General Fund.

Professor Lovering, the chairman, presented a report from the Rumford Committee, and in accordance with its recommendations the following votes were passed: —

1. That the sum of six hundred dollars be paid from the income of the Rumford Fund for the purchase of *Meyerstein's Spectrometer*, and *Regnault's Apparatus for Measuring the Tension of Vapors*, to be used by Professor Wolcott Gibbs for special investigations on Light and on Heat; the results of these investigations to be communicated to the Rumford Committee to be offered by them for publication in the "Memoirs of the American Academy of Arts and Sciences."
2. That the sum of two hundred dollars be paid from the income of the Rumford Fund for the purchase of glass prisms, to be used by Professor J. P. Cooke in investigations on the metallic spectra; the results of these investigations to be communicated to the Rumford Committee, to be offered by them for publication in the "Memoirs of the American Academy of Arts and Sciences."

Professor Lovering, as chairman of the Committee of Publication, presented a report accounting for expenditures in printing the Memoirs and Proceedings under the appropriations of the last annual meeting.

Professor Lovering also presented a report from the Rumford Committee in relation to the published works of Count Rumford.

In accordance with the recommendations of the special committee to whom was referred the subject of a revision of certain Statutes of the Academy, it was voted that the second Section of Chapter IX. be amended so as to read as follows: —

" Candidates for election as Resident Fellows must be proposed by two or more Resident Fellows, in a recommendation signed by them, specifying the section to which the nomination is made; which recommendation shall be read at a stated meeting, and then stand on the nomination list at least ten weeks, and until the balloting. No person shall be elected a Resident Fellow unless he shall have been resident in this Commonwealth one year next preceding his election; and any one so elected, who shall have resided out of the Commonwealth for the term of five years, and shall have discontinued the payment of his assessments during that time, shall be deemed to have abandoned his fellowship; provided, nevertheless, that this abandonment of fellowship for non-residence shall not apply to persons engaged in the service of the State, or of the United States."

It was also voted that the 1st Section of Chapter X. be amended so as to read as follows: —

" All proposed alterations of the Statutes, or additions to them, shall be referred to a committee, and on their report at a subsequent meeting, shall require for enactment a majority of two thirds of the members present, and at least eighteen affirmative votes."

The following additions to the Standing Votes of the Academy were also passed.

To be added to the second Vote: —

" And the current issues of the Proceedings shall be supplied, when ready for publication, free of charge, to all the Fellows and Members of the Academy, who desire to receive them."

New Vote, to be the third in order: —

" The Committee of Publication shall fix from time to time the price at which the publications of the Academy may be sold. But members may be supplied at half this price with volumes which they are not entitled to receive free, and which are needed to complete their sets."

New Vote, to be the fourth: —

" One hundred extra copies of each paper accepted for the Memoirs of the Academy shall be separately printed, of which fifty shall be placed at the disposal of the author, free of charge."

Dr. J. B. Upham of Boston was elected a Fellow in Class II., Section 4.

The annual election resulted in the choice of the following officers for the ensuing year.

Asa Gray, *President.*
Charles Beck, *Vice-President.*
William B. Rogers, *Corresponding Secretary.*
Chauncey Wright, *Recording Secretary.*
Edward Wigglesworth, *Treasurer.*
Josiah P. Cooke, *Librarian.*

Council.

Thomas Hill,	of Class I.
George P. Bond,	
John B. Henck,	
Augustus A. Gould,	of Class II.
Louis Agassiz,	
Jeffries Wyman,	
Robert C. Winthrop,	of Class III.
George E. Ellis,	
Andrew P. Peabody,	

Rumford Committee.

Joseph Lovering,
Morrill Wyman,
William B. Rogers,
Joseph Winlock,
Wolcott Gibbs,
Cyrus M. Warren.

Committee of Finance.

Asa Gray,	*ex officio*, by statute.
Edward Wigglesworth,	

J. Ingersoll Bowditch, by appointment.

The other Standing Committees were appointed on nomination of the President, as follows: —

Committee of Publication.

Joseph Lovering,
Jeffries Wyman,
Charles Beck.

Committee on the Library.

AUGUSTUS A. GOULD, WILLIAM P. DEXTER.
JOHN B. HENCK.

Committee to audit the Treasurer's Accounts.

THOMAS T. BOUVÉ, CHARLES E. WARE.

LIST

OF THE FELLOWS AND FOREIGN HONORARY MEMBERS,

MAY 24, 1864.

FELLOWS.

CLASS I. — *Mathematical and Physical Sciences.*

SECTION I.

Mathematics.

William P. G. Bartlett,	Cambridge.
Ezekiel B. Elliott,	Boston.
William Ferrel,	Cambridge.
Benjamin A. Gould,	Cambridge.
John B. Henck,	Boston.
Thomas Hill,	Cambridge.
Simon Newcomb,	Washington.
James E. Oliver,	Lynn.
Edward Pearce,	Cambridge.
Benjamin Peirce,	Cambridge.
James M. Peirce,	Cambridge.
John D. Runkle,	Cambridge.
Thomas Sherwin,	Dedham.
Chauncey Wright,	Cambridge.
Joseph Winlock,	Cambridge.

SECTION II.

Practical Astronomy and Geodesy.

George P. Bond,	Cambridge.
J. Ingersoll Bowditch,	Boston.
Alvan Clark,	Cambridge.
Charles Henry Davis,	Cambridge.
William Mitchell,	Lynn.
Maria Mitchell,	Lynn.
Robert Treat Paine,	Boston.
Henry C. Perkins,	Newburyport.
C. H. F. Peters,	Clinton, N. Y.
Truman H. Safford,	Cambridge.
George Searle,	Brookline.

SECTION III.

Physics and Chemistry.

Joseph Hale Abbot,	Beverly.
John Bacon,	Boston.
John H. Blake,	Boston.
William F. Channing,	Providence.
Thos. Edward Clark,	Williamstown.
Josiah P. Cooke, Jr.,	Cambridge.
Samuel L. Dana,	Lowell.
William P. Dexter,	Roxbury.
Charles W. Eliot,	Cambridge.
Moses G. Farmer,	Salem.
Wolcott Gibbs,	Cambridge.
Augustus A. Hayes,	Boston.
Albert Hopkins,	Williamstown.
Eben N. Horsford,	Cambridge.
Joseph Lovering,	Cambridge.